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MAKING

HIGH-DENSITY, HIGH-FLAVORED MAPLE SIRUP

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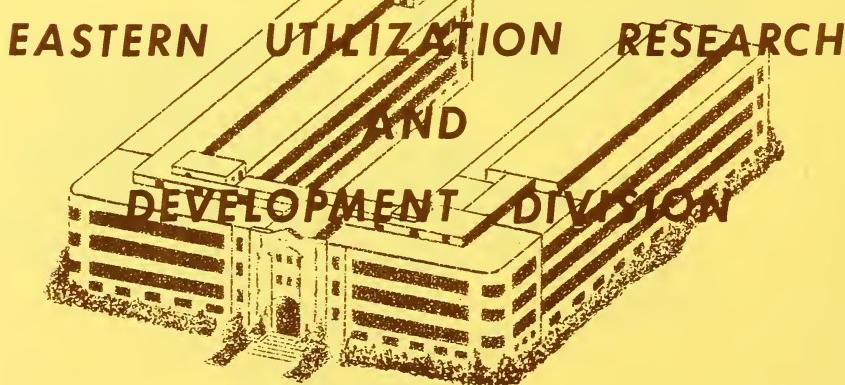


AGRICULTURAL RESEARCH SERVICE
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ABSTRACT

Procedures are given for making high-density (80° Brix) and high-flavored (fourfold intensification) maple sirup and for combining these two processes to make a thick, intensely flavored sirup.

This is a report of work done at the



Philadelphia 18, Pa.

MAKING HIGH-DENSITY, HIGH-FLAVORED MAPLE SIRUP

by

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There is a demand for a thick, pure maple sirup for use as a spread, as a nonwetting sirup for waffles, and for use particularly as an ice cream topping. When used as an ice cream topping, thick sirup must have (1) an intensity of flavor strong enough to carry through to the taste buds even after they have been partly numbed by the cold ice cream, and (2) sufficient thickness to keep it from running off the ice cream.

Two methods of processing developed at the Eastern Utilization Research and Development Division for treating maple sirup, when combined, make a sirup which has these properties. Standard density sirup (65.5° - 67° Brix), when treated by either of these processes alone, produces a product which is applicable to a wider variety of uses.

One method, called the High-Flavoring Process, produces a fourfold increase in the maple flavor of U.S. Fancy and A grades of pure maple sirup. These two top grades of maple sirup represent about 75 percent of the total United States production. While the flavor of these grades is full bodied and essentially free of the undesirable caramel flavor present in the lower grades of maple sirup, it is too mild to meet the requirements of a topping sirup.

The other method, the High-Density Process, converts relatively thin standard density sirup (65.5° - 67° Brix) to a thick sirup (75° - 80° Brix).

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High-Density Maple Sirup

The sugars of maple sirup are almost entirely sucrose with only a small amount of invert sugar. Because of this, maple sirup cannot be concentrated above 67° Brix. At higher concentrations, sucrose tends to crystallize on storage at room temperature.

A thicker, more concentrated sirup could be made which would not crystallize on storage at room temperature by reducing appreciably the sucrose concentration. This can be done by changing a part of the sucrose to invert sugar (fructose and glucose) by use of an enzyme (invertase)*. The enzyme promotes splitting of the sucrose into equal amounts of glucose and fructose (invert sugar). When about one-half the sucrose has been "inverted," the sirup can be concentrated to about 80° Brix without danger of crystallization even during long periods of storage. In practice, the sirup is first thickened to about 80° Brix by boiling off some of the water, and the amount of sucrose of the thick sirup is then lowered by treatment with the enzyme. This sequence of concentration and inversion must be followed to avoid impairment of the maple flavor.

Directions for Making High-Density Maple Sirup

1. Transfer a measured amount of U.S. Fancy or U.S. Grade A sirup to a kettle.
2. Boil the sirup until its boiling temperature has been elevated 19° to 20° F. above that of boiling water.
3. Allow the sirup to cool (with occasional stirring) to between 130° and 135° F. (check temperature with a thermometer). In this temperature range the thick (80° Brix) sirup will be fluid.
4. Add to the warm sirup 2-1/2 to 3 ounces of commercial invertase for each gallon or for 11 pounds of the original weight of sirup used.

Note: If the enzyme solution is added to sirup whose temperature is above 140° F., enzyme activity may be partly or wholly destroyed and little or no inversion of the sucrose will take place.

* The enzyme invertase sold under a variety of trade names can be obtained from candy manufacturers.

5. Thoroughly mix the added enzyme throughout the warm 80° Brix sirup by stirring.

6. Immediately transfer the enzyme-treated 80° Brix sirup to a clean container.

7. Cover well or seal the containers and store at room temperature. At storage temperatures of approximately 70° F., the inversion process will be completed in about 2 weeks, with about 50 percent of the sucrose inverted. At slightly warmer storage temperatures (up to about 90° F.) shorter times are required for the inversion.

If the enzyme-treated sirup is stored in glass containers, it will be noted that at first the sirup will tend to crystallize and form either a very soft "mush" or a deposit on the bottom. As the enzyme action progresses, these crystals will begin to dissolve and finally disappear, indicating that inversion is completed and that the high-density sirup is ready for use. The time needed to complete the inversion process can be shortened by occasionally stirring the crystals or by inverting the container.

High-Flavored Maple Sirup

Most maple sirup sold commercially, especially sirup of the two top grades, contains substances which can be induced to form much more maple flavor. This is done by subjecting the sirup to a much higher temperature than was used in the normal process of evaporating sap to sirup, and then holding the sirup at this elevated temperature for a considerable period of time. This higher temperature can be achieved by heating at atmospheric pressure at an elevated boiling point or by heating under pressure as in a pressure cooker.

The High-Flavored Process does not concentrate the flavor. Instead, it develops additional maple flavor above that originally present in the sirup.

Directions for Making High-Flavored Maple Sirup

High-flavored maple sirup can be made either by the atmospheric or by the pressure-cooking process. Regardless of the process used, select only U.S. Fancy or U.S.

Grade A sirup for high-flavoring. If the Fancy grade is used, its color should be close to the light amber of the United States Department of Agriculture Color Grader.

A. The Atmospheric Process

The atmospheric process can be used only when high-pressure steam is available as a heat source. The process is not recommended for use when heating is done over an open flame.

1. Transfer the sirup to an open kettle heated either by steam coils in the bottom or by a steam jacket. In either case, steam pressures of 30 to 100 pounds per square inch (p.s.i.) are to be used to heat the sirup, depending on the amount of sirup to be processed.

2. Heat the sirup to boiling and, to minimize foaming during the first few minutes of boiling, add a pea-sized piece of butter or a few drops of cooking oil.

3. Continue the boiling until the sirup temperature reaches 250° to 253° F.

4. Reduce the steam pressure sufficiently to stop the active boiling but yet high enough to maintain the sirup temperature at 250° to 253° F. Cover the kettle to prevent further loss of water through evaporation.

5. Maintain this temperature for from 1/2 to 1-1/2 hours. The length of this heating period is best determined by lifting the cover and sniffing the vapor. Stop the heating as soon as an acrid, caramel odor is detected since this indicates that the high-flavoring is completed.

6. Allow the sirup to cool to approximately 180° F.

7. Add water to replace that which was boiled off. The amount to be added should be slightly more than that removed as steam.

8. The sirup is again brought to a boil and the heating continued until the boiling point reaches that of standard density sirup (7° F. above the temperature of boiling water). This yields a standard density, high-flavored maple sirup.

9. This high-flavored sirup can be used for making high-density (80° Brix) sirup. Continue the heating of this sirup (step number 8) until the boiling point is elevated 19° to 20° F. above the boiling point of water.

10. Convert to high-density sirup by following the "Directions for Making High-Density Maple Sirup," given above, beginning with step number 3.

B. The Pressure-Cooking Process

For large quantities of sirup this process requires the use of special food processing retorts heated by high-pressure steam. For smaller quantities (pints and quarts), the common household pressure cooker can be used. In this process, standard density sirup is heated in a closed cooker at 15 p.s.i. During the heating the sirup remains at constant volume and at standard density. In the atmospheric process of high-flavoring, the water content of the sirup is about 10 percent; in the pressure-cooking process, it is about 35 percent. This high content of water is conducive to the formation of caramel flavor during heating. However, the rate of undesirable caramel formation depends upon the original caramel content of the sirup employed for high-flavoring. The higher the caramel content in the original sirup, the greater will be the amount formed in the product. Since the lighter grades of sirup have a low caramel content, it is important to use only U.S. Fancy or U.S. Grade A maple sirup for high-flavoring, especially when the pressure-cooking process is used.

1. Preheat the sirup to boiling and immediately transfer it to jars, filling them to within one-half inch of the top.

2. Set the jar lids loosely in place and put the jars in the pressure cooker which should contain the amount of water specified by the manufacturer.

3. Attach the cooker cover and lock it in place.

4. Vent the excess air and generate steam in the cooker according to the manufacturer's directions.

5. Heat the sirup for 1 to $1\frac{1}{2}$ hours after the pressure has reached 15 p.s.i. taking care not to vent too

much steam, because of excessive heating during the heating period.

6. Remove the cooker from the heat and allow the pressure to decrease slowly to zero pounds without venting or quenching. Do not jostle the containers since the super-heated sirup may boil over.

This sirup, without further adjustment of density, is a high-flavored, standard density sirup and will have approximately four times the initial maple flavor intensity. This sirup can be used for making maple sirup blends or it can be converted into a high-density sirup.

7. This high-flavored sirup can be used for making high-density (80° Brix) sirup. Heat it until the temperature is elevated 19° to 20° F. above that of boiling water. This concentrated (80° Brix), high-flavored sirup is now ready for conversion to high-density sirup.

8. Convert to high-density sirup by following the "Directions for Making High-Density Maple Sirup," given above, beginning with step number 3.

